

REMARKS

In view of the above amendments and following remarks, reconsideration of the rejections contained in the Office Action of January 7, 2004 is respectfully requested.

The Examiner's rejections of claims 23, 27, 33 and 34 have been rendered moot by the cancellation of these claims. It is noted that claims 33 and 34 were previously canceled.

In the Office Action the Examiner rejected claims 25 and 30 as being anticipated by Warden, U.S. Patent 4,455,668. Further, claims 21 and 23 were rejected as being unpatentable over Warden in view of Mustain, U.S. Patent 4,829,547. Further, claims 26-29 and 31-32 were rejected as being unpatentable over Warden in view of Armistead, U.S. Patent 4,852,131. Claims 22 and 24 were rejected as being unpatentable over Warden in view of Mustain and Armistead. However, it is respectfully submitted that the present invention patentably distinguishes over these references for the reasons as will be discussed below.

Independent claim 21 has now been amended to recite that the X-ray detecting device is swung in translational motion about a straight vertical line as an axis, with the straight line lying in a plane of the vertical section of the sample while maintaining an incidence plane of the X-ray detecting device parallel to the vertical section of the sample. This produces a vertical sectional image of the sample by detecting the X-rays passing through the sample with the X-ray detecting device.

Further, claim 25 has been amended to recite that the X-ray detecting device produces a vertical sectional image of the sample. The X-ray detecting device has an X-ray incidence plane arranged to be parallel to a vertical straight line.

The combination of features now recited in independent method claim 21 and independent apparatus claim 25 are not suggested by the prior art cited by the Examiner.

As can be seen from the above, each of the independent claims has now been limited toward the production of the vertical sectional image of the sample. Support for this limitation is found throughout the specification. Noting Fig. 2, when a BGA 1, for example, of a printed circuit board 2 is placed on a stage 14 for inspection, a vertical sectional image taken along a line of ball connections can provide images as shown in Figs. 5 for inspection of the condition of the connection.

This type of image is preferable for the inspection of the connections, as discussed at the bottom of page 10 of the original specification.

As the Examiner acknowledges in the rejections employing the patent to Armistead, Warden fails to teach that a subject section of the sample is in a plane containing the straight line and parallel to the X-ray incidence plane and the section is vertical to the stage. However, the Examiner cites Armistead for teaching this proposition.

However, it is respectfully submitted that the present invention is not properly taught by any suitable combination of Warden, Mustain and Armistead.

Warden and Mustain are similar to some degree in that both relate to X-ray examination apparatuses for the purpose of taking X-rays of patients, i.e. people. As discussed beginning at line 17 of column 3 of Warden, in tomography examination a region to be recorded of a patient at a subject plane P is horizontal. The device allows X-rays to be taken in a number of different angular positions. As noted beginning at line 47 in Warden, through toothed segments 8, rotatable and arrestable in any desired position, tomography examination can proceed from any random angular position. As noted in Warden, this has the advantage that the patient during such an examination can always be supported in a position which is comfortable for the patient. In other words, it is important to maintain the patient horizontal.

The Examiner cites Armistead as teaching an X-ray and detector arranged horizontal to a plane of a sample holder, referencing Fig. 4. The Examiner concludes that it would have been obvious to change the direction of the radiation source and detector so that the direction of the X-ray beam is horizontal to a plane of an object stage as shown in Fig. 4 while a section plane of the object is vertical to the plane of the object stage. However, this does not follow from the teachings of Armistead.

Armistead addresses tomography inspection apparatus for electronic devices for inspecting things such as solder bonds. However, in Armistead, a large number of images are taken and processed with software in order to obtain a vertical sectional image. With this method, a lot of time (about 1 minute) is spent on software processing. This means that the technique is not particularly suitable for use at a manufacturing site.

With the present invention, on the other hand, no software processing is conducted in order to obtain the vertical sectional image. The vertical sectional images can be obtained through a hardware-based action of the mechanism without the need for software processing, and only takes about 2 seconds to obtain the image. This makes it possible to quickly determine the quality of products at the manufacturing site.

Thus the present invention as now reflected by independent claims 21 and 25 presents a unique combination of features that results in a device that is eminently more useful at a manufacturing site for the inspection of components. Moreover, it is not suggested by the references cited by the Examiner.

As discussed, Armistead takes a long time to produce the required image. Of issue, of course, is whether it would have been obvious to one of ordinary skill in the art, as the Examiner suggests, to change the imaging direction from the teachings of Armistead in Warden. However, there is no suggestion from Armistead to modify Warden.

The Examiner alleges that the arrangement of Armistead would allow one to image different views of the object. This may be true. However, there is no suggestion from Warden or Armistead that different view are necessary or desirable. It is important to consider that Warden relates to X-ray examination of a patient, while Armistead relates to X-ray inspection of an electronic component. The problems and considerations involved with both are quite different. One of ordinary skill in the art would not look to a reference such as Armistead for making any modification to Warden.

More to the point, there is no problem or deficiency or advantage recognized in either of Warden or Armistead that leads one to modify Warden. There is no indicated advantage or desire from applying any teaching of Armistead to Warden. There is no apparent reason suggested why the particular way of imaging of Armistead would be useful for imaging a patient with a device in Warden.

In other words, the Examiner cites the motivation of allowing one to image different views of the object according to the teachings of Armistead. But there is no reason provided why one would want to do this in the first place. Doing so, it does not, from the teachings of the references,

provide any apparent advantage or utility. There is no real reason why one of ordinary skill in the art would attempt any modification of the one with the other.

In fact, the only basis for combining the features of each of these references in a particularly useful way comes from Applicant's specification. Applicant has recognized the utility of vertical sectional imaging for X-ray inspection of a sample. There is insufficient suggestion to start undertaking wholesale modifications of the structure of Warden from the simple fact of a different arrangement in Armistead when such is used for a very different purpose.

The distinctions with the prior art are further emphasized by dependent claims 22 and 24, emphasizing the relationship to the stage. This is also true of dependent claims 26, 28 and 29.

From the above, it is respectfully submitted that it is clear that the present invention as defined by independent claims 21 and 25 present a unique and patentable combination of features and advantages not suggested by the prior art. Indication of the patentability of the claims corresponding to the invention is, accordingly, requested.

Attached hereto, for the Examiner's benefit, is a brochure illustrating the actual product corresponding to the present invention which is on the market.

Applicant reserves the right to further argue against and traverse and provide further evidence with respect to any additional positions taken by the Examiner in the Office Action which have not been addressed above.

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance, and the Examiner is requested to pass the case to issue. If the Examiner should have any comments or suggestions to help speed the prosecution of this application, the Examiner is requested to contact Applicant's undersigned representative.

Respectfully submitted,

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